

Claims

1. A polishing head in an apparatus for chemically-mechanically polishing semiconductor wafers, the polishing head comprising:

5 (a) a first side having at least a portion thereof operably connectable with a spindle on the apparatus; and

(b) a second side opposite the first side, the second side having a substantially spherical cap shape comprising an outer region adapted to apply a first force onto a semiconductor wafer against a polishing pad, and an inner region adapted to apply a second force onto the semiconductor wafer against the polishing pad, the second force being different from the first force, whereby the first force and the second force cause the polishing pad to planarize the semiconductor wafer substantially uniformly.

10

2. The polishing head of claim 1 wherein the substantially spherical cap shape is concave relative to the semiconductor wafer.

15

3. The polishing head of claim 2 wherein an angle defined by a point of contact between the concave substantially spherical cap shape and the semiconductor wafer is less than 10 degrees.

4. The polishing head of claim 2 wherein an angle defined by a point of contact between the concave substantially spherical cap shape and the semiconductor wafer is less than 5 degrees.

20

5. The polishing head of claim 1 wherein the substantially spherical cap shape is convex relative to the semiconductor wafer.

6. The polishing head of claim 1 wherein the second side further comprises a flat rim around the outer perimeter of the substantially spherical cap shape.

7. The polishing head of claim 6 wherein the flat rim has a width of less than about 5 mm.

8. The polishing head of claim 1 wherein the apparatus for chemically-mechanically polishing semiconductor wafers is a TERES apparatus.

9. A method of polishing a semiconductor wafer in a chemical mechanical polishing apparatus, the method comprising:

(a) providing a chemical mechanical polishing apparatus having a polishing head comprising a first side having at least a portion thereof in contact with a spindle on the apparatus, and a second side opposite the first side, the second side having a substantially spherical cap shape comprising an outer region and an inner region;

(b) securing the semiconductor wafer in the polishing head, the semiconductor wafer having a center region and a perimeter region;

(c) inserting a polishing pad in the apparatus; and

(d) applying a first force using the outer region of the spherical cap shape, the first force tending to press a perimeter region of the semiconductor wafer against a polishing pad;

(e) applying a second force using the inner region of the spherical cap shape, the second force being different from the first force and tending to press a center region of the semiconductor wafer against the polishing pad; and

(f) polishing the semiconductor wafer such that the first force and the second force cause the polishing pad to remove semiconductor surface at substantially the same rate in the center region and in the perimeter region of the semiconductor wafer.

10. The method of claim 9 wherein steps (d), (e), and (f) are performed simultaneously.

11. The method of claim 9 wherein during the polishing step (d), the polishing pad rotates about an axis substantially perpendicular to the semiconductor wafer.

12. The method of claim 9 wherein during the polishing step (d), the polishing pad remains stationary.

13. The method of claim 9 wherein during the polishing step (d), the semiconductor wafer is stationary.

14. The method of claim 9 wherein during the polishing step (d), the semiconductor wafer rotates about an axis in the center region of the

semiconductor that is perpendicular to the surface of the semiconductor wafer.

15. The method of claim 9 wherein the first force is greater than the second force.

5 16. The method of claim 9 wherein the second side also has a flat rim surrounding the substantially spherical cap shape.

17. The method of claim 16 wherein the first force is applied to the perimeter region of the semiconductor using both the flat rim surrounding the substantially spherical cap shape and the outer region of the substantially spherical cap shape.

18. The method of claim 9 wherein the substantially spherical cap shape is concave relative to the semiconductor wafer.

19. A polishing head in an apparatus for chemically-mechanically polishing semiconductor wafers, the polishing head comprising:

15 (a) a first side having at least a portion thereof operably connectable with a spindle on the apparatus; and

(b) a second side opposite the first side, the second side having a flat rim surrounding a substantially spherical cap shape that is concave relative to a semiconductor wafer, the spherical cap shape comprising an outer region that, in conjunction with the flat rim, is adapted to apply a first force onto a semiconductor wafer against a polishing pad, and an inner region adapted to apply a second force onto the semiconductor wafer

20

005430-04301
T05240 "005430"

against the polishing pad, the second force being different from the first force, whereby the first force and the second force cause the polishing pad to planarize the semiconductor wafer substantially uniformly.